#T143 – Hennepin 138kV
Generation Interconnection

Option 1:

Attachment Facilities

The T143 project was studied as a 600 MW Energy (120 MW Capacity) injection into the tap to Hennepin Station on the Kewanee to Streator 138kV line #6101 and the Crescent Ridge to Mazon 138kV line #7713 in the ComEd area.

Revenue Metering and SCADA Requirements

For PJM: IC will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

For ComEd: IC will be required to install equipment necessary to provide bi-directional Revenue Metering (KWH, KVARH) and real time data (KW, KVAR, circuit breaker status, and 138 kV voltage) for IC's generating Resource. See ComEd Applicable Standards available on the PJM website ("TO Standards") – "Exelon Energy Delivery Interconnection Guidelines (Generators Greater than 20 MVA)".

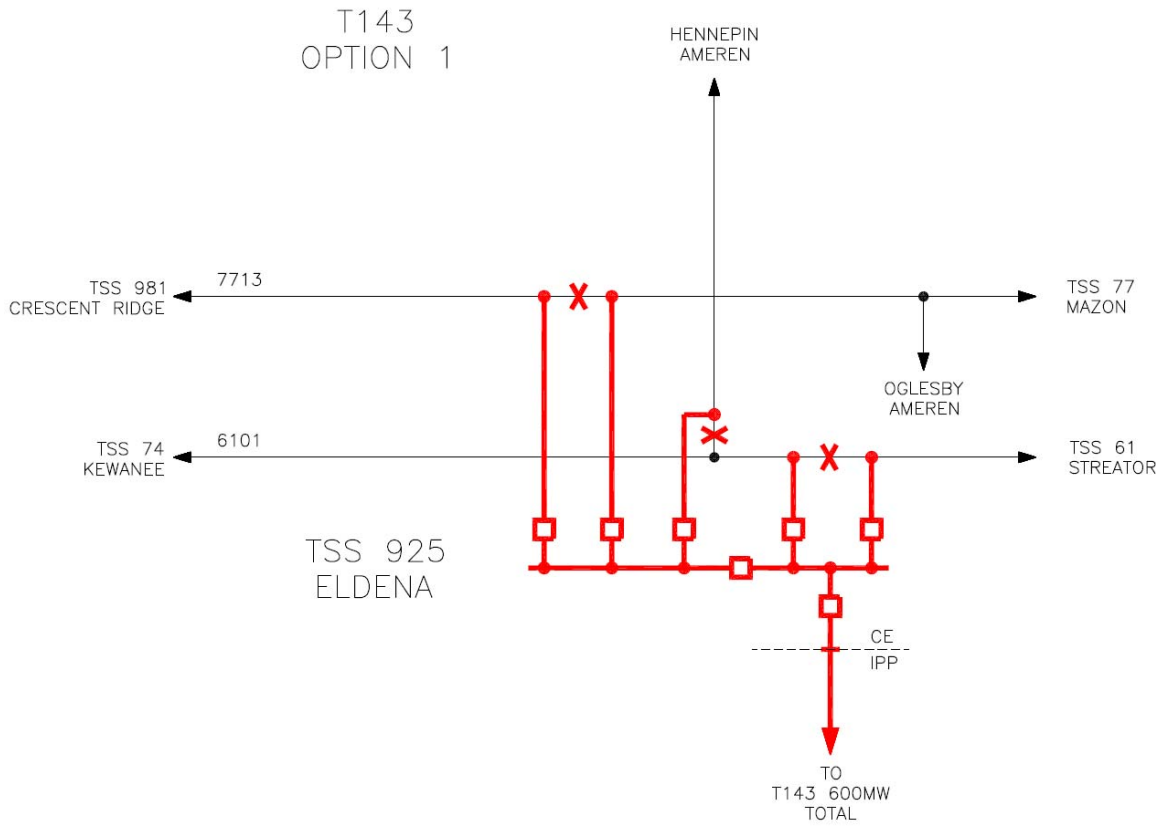

Figure 1. Option 1 Proposed Interconnection

Network Impacts

The T143 project was studied as a 600 MW Energy (120 MW Capacity) injection into the tap to Hennepin Station on the Kewanee to Streator 138kV line #6101 and the Crescent Ridge to Mazon 138kV line #7713 in the ComEd area. Project T143 was evaluated for compliance with reliability criteria for summer peak conditions in 2012.

The results of this study and others performed for earlier queued projects indicate that with the large amount of proposed generation in the Kewanee area the existing 138 kV system near Kewanee is inadequate to support all this generation. These studies also show that installation of all of these projects cannot be accommodated by the ComEd transmission system without the addition of major extra high voltage (EHV) reinforcements. The T143 project contributes to many of the same violations that were initially caused by earlier projects in the R and T queues. Upgrades required by these earlier queued projects include four new 345kV lines. It is not feasible to further expand the 138kV system in the Hennepin area. Thus to accommodate the T143 project, a "345kV backbone" would be required. These large upgrade projects may have costs in the **hundreds of millions of dollars** and the T143 may be responsible or have some cost allocation to them. Subsequent studies may indicate a different set of upgrades that this project may be assessed and will depend on whether earlier queued projects withdraw.

Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

Table 1 - Generator Deliverability Impacts								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
1a	T143	46.7	T143 to Oglesby Tap portion of T143 – Oglesby Tap – Mazon 138 kV line #7713	76.0%	118.5%	Emergency	110	T143 to Hennepin Station 138 kV line (Formerly line #6101)

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

Table 2 - Multiple Facility Contingency Impacts								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
2a	T143	410.3	T143 to Hennepin Station 138 kV line (Formerly line #6101)	52.6%	246.2%	Applicable Load Dump	212	Kewanee to T143 138 kV line #6101 & Crescent Ridge to T143 138 kV line #7713
2b	T143	124.1	LaSalle Co to Kickapoo Creek (N15) 138 kV line #0112	85.8%	121.9%	Applicable Load Dump	344	Joilet - Minooka - Goose Lake - Dresden Red 138 kV Line #0903 & Dresden - Channahon West - Mazon Red 138 kV line #1206
2c	T143	61.9	Katydid Rd to Dresden Blue 345kV line #1202	98.4%	102.0%	Applicable Load Dump	1718	Powerton to Livingston 2 Wind Farm (O27) Red 345 kV line #0303 & Katydid Rd to Goodings Grove Blue 345 kV line #19601

Short Circuit

(Summary of impacted circuit breakers)

To be determined in the System Impact Study.

Contribution to Previously Identified Overloads

(T143 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Table 3 - Contribution to Previously Identified Overloads								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
3a	T143	315.7	T143 to Hennepin Station 138 kV line (Formerly line #6101)	122.1%	271.0%	Applicable Load Dump	212	LaSalle Co – LaSalle Co Pump – Mazon 138 kV line #0108 & T143 – Oglesby Tap – Mazon 138 kV line #7713
3b	T143	12.7	P39 Option 2 to E D Edwards 138 kV line #7423	140.9%	148.7%	Applicable Load Dump	164	Kewanee to T143 138 kV line #6101 & Crescent Ridge to T143 138 kV line #7713
3c	T143	61.9	Katydid Rd to Dresden Blue 345kV line #1202	106.4%	110.0%	Applicable Load Dump	1718	Katydid Rd to Goodings Grove Blue 345 kV line #19601 & Livingston 2 Wind Farm (O27) to Goodings Grove Red 345 kV line #97503

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

To be determined in the System Impact Study.

Stability and Reactive Power Requirement for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined in the System Impact Study.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

It is not feasible to further expand the 138kV system in the Hennepin area. Thus to accommodate the T143 project, a “345kV backbone” would be required. Details of the “345kV backbone” will be addressed in the System Impact Study.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

Byron/Nelson Area

Previous projects in the PJM Queue have established the need for two 345 kV lines from Byron to Wayne and a second Byron to Nelson 345 kV line to satisfy ComEd’s transient stability criteria.

- ***Summary of Required Upgrades to Satisfy Stability Criteria***

    1. First 345kV transmission line between Byron and Wayne (56 miles). This line is required to mitigate transient stability criteria violations initially caused by the R16 project. The cost estimate for this upgrade is $**250,000,000**. (PJM Network Upgrade# N**1606**). The T143 project may have a cost allocation to this upgrade.

    2. Second 345kV transmission line between Byron and Wayne (56 miles). This line is required to mitigate transient stability criteria violations initially caused by the R33 project. The cost estimate for this upgrade is $**50,000,000** (PJM Network Upgrade# N**1638**). The T143 project may have a cost allocation to this upgrade.

    3. A new 345kV transmission line between Byron and Nelson (33 miles). This line is required to mitigate transient stability criteria violations initially caused by the R33 project. The cost estimate for this upgrade is $**125,000,000** (PJM Network Upgrade# N**1639**). The T143 project may have a cost allocation to this upgrade.

- ***Summary of Required Upgrades to Satisfy Thermal Criteria***

    A new 31-mile 345 kV Cherry Valley to Pleasant Valley line is proposed. One 345kV breaker at Cherry Valley substation and a three-breaker 345kV ring bus at Pleasant Valley will be required to terminate the proposed line. This line will provide a second 345 kV path between Cherry Valley and Silver Lake. The estimated costs for these facilities are $**97,000,000**. The T143 project may have a cost allocation to this upgrade.

Potential Issues

Since the analysis was completed for T143, several R queue projects have withdrawn from the PJM queue. This means that possibly some of the overloads mentioned in the Contributions to Previously Identified Overloads may now initially be caused by the T143 project. All suggested upgrades will be reevaluated in the System Impact Study.

Other projects in the T-Queue prior to T143 demonstrate the need for long-lead time facilities including a 765 kV "backbone" transmission system tying the Byron area to the transmission system east of ComEd. While project T143 may have some contributions to the need for this 765 kV "backbone", it may be possible to place T143 in service prior to construction of the 765kV "backbone". Including the 765 kV "backbone", the cost of all of the upgrades mentioned above can be in the range of **billions of dollars**.

Additional studies will be performed during the System Impact and Facilities Studies to determine the ability to add project T143 prior to the installation of the 765 kV "backbone". These studies will also develop the optimum plan to address these issues. If the 765kV reinforcement upgrades are built, additional studies will also be performed regarding cost allocation among these various projects.

The impacts on the AEP system due to the expansion of the 765kV system in ComEd and the new 765kV tie lines to AEP have not been studied. Additional system reinforcements may be required due to Project T143 and these line additions.

Impacts on the MISO member transmission systems are not included in this analysis, but they will be included in the Impact Study, which may reveal upgrades needed in the MISO system not identified in this Feasibility Study.

Delivery of Energy Portion of Interconnection Request

There are several wind generation plants proposed in the general area of the T143 project, each with only 20% of their peak output level considered as a Capacity Resource, and the remaining 80% as an energy only resource. If all of the wind generation plants are at their maximum output level simultaneously, a significant number of the transmission facilities, and many underlying system facilities are likely to be overloaded, restricting operation to a lower output level.

PJM and the Transmission owner studied the delivery of the energy portion of this interconnection request. The following analysis has been performed to inform the Interconnection Customer of potential congestion issues (operational restrictions) that may occur and affect the T143 project's ability to operate at full output for certain system conditions. The overloads listed below are not required reliability upgrades for the Queue T143 interconnection. Please note that the upgrades for the facilities identified below may be quite extensive with a number of these facilities possibly requiring reconductoring/rebuilding of transmission lines. Some of the reconductoring/rebuilding projects can be done in a short time frame while others are quite extensive and will require a long time to complete. In general, the time necessary to design and rebuild an extensive facility upgrade will take approximately 2-3 years to complete. If the T143 Interconnection Customer wants to pursue construction of any of these upgrades, a separate Transmission Interconnection request must be submitted and the upgrades must be performed as merchant transmission projects.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, the following overloads were identified:

Table 4 - Delivery of Energy Portion of Interconnection Request								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
4a	T143	383.4	T143 to Hennepin Station 138 kV line (Formerly line #6101)	45.3%	284.9%	Emergency	160	T143 to Streator 138 kV line #6101
4b	T143	233.7	T143 to Oglesby Tap portion of T143 – Oglesby Tap – Mazon 138 kV line #7713	238.4%	450.9%	Emergency	140	T143 to Hennepin Station 138 kV line (Formerly line #6101)
4c	T143	88.2	Oglesby Tap to Mazon portion of T143 – Oglesby Tap – Mazon 138 kV line #7713	134.5%	211.2%	Emergency	115	Powerton Blue to Powerton Red 345 kV bus tie & Powerton Red to Cayuga Ridge North (O27) 345 kV line #0303
4d	T143	17.0	Kewanee Main bus to South T-bus 138 kV bus tie breaker 3-4	264.6%	272.3%	Emergency	221	Normandy to Schauff Rd Red 138 kV line #12511
4e	T143	27.3	Kewanee Main 138 kV Bus	168.5%	179.7%	Emergency	244	Normandy to Schauff Rd Red 138 kV line #12511
4f	T143	29.8	Kewanee to P39 Option 2 138 kV line #7423	113.1%	134.4%	Normal	140	No Contingency
4g	T143	29.2	P39 Option 2 to E D Edwards 138 kV line #7423	130.0%	150.5%	Emergency	143	Powerton to Benson 345 kV line #0302 and Powerton Unit #5 (Powerton SPOG 1-3-b)
4h	T143	71.4	Kewanee to Normandy Red 138 kV line #7411	121.0%	158.4%	Emergency	191	Kewanee - Normandy - Schauff Rd Blue 138 kV line #7408
4i	T143	44.1	Normandy to Schauff Rd Red 138 kV line #12511	196.0%	227.5%	Normal	140	No Contingency
4j	T143	69.6	Kewanee to Normandy Blue portion of the Kewanee - Normandy - Schauff Rd 138 kV line #7408	121.6%	154.8%	Emergency	210	Normandy to Schauff Rd Red 138 kV line #12511
4k	T143	69.6	Normandy Schauff Rd Blue protion of the Kewanee - Normandy - Schauff Rd 138 kV line #7408	92.0%	118.2%	Emergency	265	Kewanee to Normandy Red 138 kV line #7411
4l	T143	88.6	Nelson Tap to Schauff Rd portion of the Nelson-Dixon-Schauff Rd 138 kV line #15508	236.3%	269.8%	Emergency	265	Rock Falls to Schauff Rd Red 138 kV line #13311
4m	T143	82.2	Nelson Tap to Dixon TDC portion of the Nelson-Dixon-Schauff Rd 138 kV line #15508	129.7%	148.1%	Emergency	445	Nelson 345/138 kV transformer #82
4n	T143	82.2	Dixon TDC to Dixon portion of the Nelson-Dixon-Schauff Rd 138 kV line #15508	133.7%	153.2%	Emergency	420	Nelson 345/138 kV transformer #82
4o	T143	41.9	Nelson to Nelson Tap portion of the Nelson-Dixon-Schauff Rd 138 kV line #15508	114.0%	128.9%	Emergency	280	Rock Falls to Schauff Rd Red 138 kV line #13311

Table 4 - Delivery of Energy Portion of Interconnection Request (Continued)								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
4p	T143	85.7	Rock Falls to Schauff Rd Red 138 kV line #13311	320.4%	367.0%	Emergency	184	Nelson-Dixon-Schauff Rd 138 kV line #15508
4q	T143	85.7	Rock Falls to Nelson Red 138 kV line #15509	293.5%	340.1%	Emergency	184	Nelson-Dixon-Schauff Rd 138 kV line #15508
4r	T143	85.7	Nelson 345/138 kV transformer #82	112.4%	130.3%	Emergency	480	Nelson-Dixon-Schauff Rd 138 kV line #15508
4s	T143	69.3	LaSalle Co Pump to Mazon portion of the LaSalle Co – LaSalle Co Pump – Mazon 138 kV line #0108	91.8%	122.6%	Emergency	225	LaSalle Co 345/138 kV transformer #81
4t	T143	106.9	LaSalle Co to Kickapoo Creek (N15) 138 kV line #0112	111.5%	152.6%	Emergency	260	Lockport to Kendall Co EC Blue 345 kV line #10805
4u	T143	43.7	Powerton to Powerton JCT B portion of the Powerton - Havana - Tremont 138 kV line #1352	95.3%	125.9%	Normal	155	No Contingency

Note: *The analysis of the Potential Congestion Issues section was performed without any of the required upgrades mentioned earlier in this report.*

Option 2:

Attachment Facilities

The queue T143 project's secondary option was studied as a 600MW Energy (120MW Capacity) injection into ComEd's 345kV system between the Electric Junction (blue) and Nelson (blue) substations on 345 kV line 15502.

Revenue Metering and SCADA Requirements

For PJM: IC will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

For ComEd: IC will be required to install equipment necessary to provide bi-directional Revenue Metering (KWH, KVARH) and real time data (KW, KVAR, circuit breaker status, and 138 kV voltage) for IC's generating Resource. See ComEd Applicable Standards available on the PJM website ("TO Standards") – "Exelon Energy Delivery Interconnection Guidelines (Generators Greater than 20 MVA)".

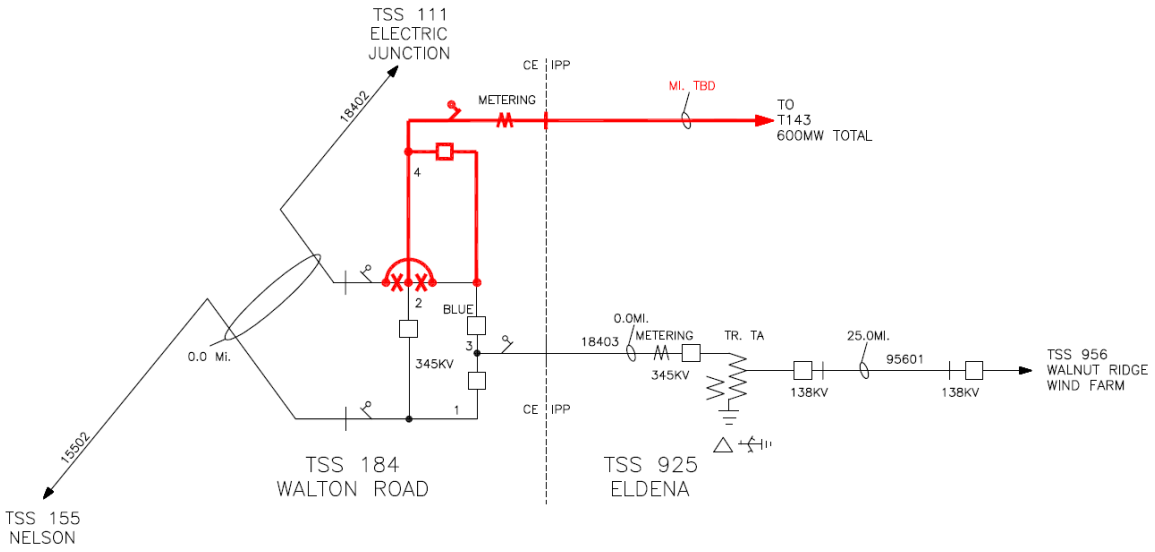

Figure 2. Option 2 Proposed Interconnection

Network Impacts

The queue T143 project's secondary option was studied as a 600MW Energy (120MW Capacity) injection into ComEd's 345kV system between the Electric Junction (blue) and Nelson (blue) substations on 345 kV line 15502. Project T143 was evaluated for compliance with reliability criteria for summer peak conditions in 2012.

The T143 project contributes to many of the same violations that were initially caused by earlier projects in the R, S and T queues. Upgrades required by these earlier queued projects included four new 345kV lines: two 345kV Byron to Wayne lines, one 345kV Byron to Nelson line and one 345kV Cherry Valley to Pleasant Valley line (See Contributions to Previously Identified Reinforcements). These large upgrade projects may have costs in the **hundreds of millions of dollars** and the T143 may have some cost allocation to them. Subsequent studies may indicate a different set of upgrades that this project may be assessed and will depend on withdrawal of earlier queued projects.

Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

Table 1 - Generator Deliverability Impacts

Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
1a	T143	13.9	Nelson 345/138 kV transformer #82	98.8%	101.7%	Emergency	480	Walnut Ridge Wind Farm (P20) to Electric Junction 345 kV line 18402 (Formerly line #15502)

Multiple Facility Contingency

(Double Circuit Tower Line Contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

No problems were identified.

Short Circuit

(Summary of impacted circuit breakers)

To be determined in the System Impact Study.

Contribution to Previously Identified Overloads

(T143 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Table 2 - Contribution to Previously Identified Overloads								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
2a	T143	25.7	Marengo Red Tap to Pleasant Valley portion of Belvidere – Marengo – Pleasant Valley Red 138 kV line #12204	446.7%	454.9%	Applicable Load Dump	316	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2b	T143	15.1	Marengo Tap to Woodstock Blue portion of Belvidere – Marengo - Woodstock 138 kV line #12205	301.7%	306.4%	Applicable Load Dump	316	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2c	T143	80.7	Cherry Valley to Silver Lake 345 kV line #15616	265.5%	269.5%	Applicable Load Dump	2033	Wempletown to T92T93 Blue 345 kV line #17101 & Wempletown to T92T93 Red 345 kV line #17102
2d	T143	105.5	Byron to Wempletown 345 kV line #0624	261.7%	266.4%	Applicable Load Dump	2245	Byron to Cherry Valley Red 345 kV line #0622 & Byron to Cherry Valley Blue 345 kV line #0621
2e	T143	15.1	Woodstock to Pleasant Valley Blue 138 kV line #14106	249.6%	253.9%	Applicable Load Dump	345	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2f	T143	8.3	Crescent Ridge to Hennepin tap 138 kV line #7713	285.7%	292.9%	Applicable Load Dump	116	Electric Junction - N Aurora - Sugar Grove - Waterman - Glidden 138 kV line #11106 & P20 to Electric Junction 345 kV line #18402
2g	T143	234.2	Nelson to P20 345 kV line #15502	224.1%	239.0%	Applicable Load Dump	1572	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2h	T143	16.0	Q57 to W DeKalb Tap portion of Waterman 138 kV line #11323	245.9%	251.0%	Applicable Load Dump	316	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2i	T143	79.8	Byron to Cherry Valley Red 345 kV line #0622	198.0%	201.9%	Applicable Load Dump	2024	Byron to Cherry Valley Blue 345 kV line #0621 & Cherry Valley to Dixon 138 kV line #15621
2j	T143	16.1	McGirr Rd. to H440 (Rochelle) Tap portion of McGirr Rd.-H440-Steward 138 kV line 16914	190.4%	202.1%	Applicable Load Dump	345	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2k	T143	76.3	Byron to Cherry Valley Blue 345 kV line #0621	189.4%	193.2%	Applicable Load Dump	2024	Byron to Cherry Valley Red 345 kV line #0622 & Cherry Valley to Dixon 138 kV line #15621
2l	T143	16.0	Steward to Haumesser Rd (Q57) 138 kV line 18623	223.2%	229.0%	Applicable Load Dump	279	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2m	T143	15.1	H440 (Rochelle) Tap to Steward portion of McGirr Road - H440 - Steward 138 kV line #16914	179.1%	183.7%	Applicable Load Dump	332	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2n	T143	11.4	Pleasant Valley to Crystal Lake Blue portion of the Pleasant Valley-Crystal Lake-McHenry-Pleasant Valley 138 kV line 13809	170.4%	173.7%	Applicable Load Dump	345	Silver Lake to Pleasant Valley 345 kV line 13817 & Cherry Valley to Silver Lake 345 kV line #15616
2o	T143	11.1	Pleasant Valley to Crystal Lake Red 138 kV line 14101	164.5%	167.8%	Applicable Load Dump	345	Silver Lake to Pleasant Valley 345 kV line 13817 & Cherry Valley to Silver Lake 345 kV line #15616

Table 2 - Contribution to Previously Identified Overloads (Continued)								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
2p	T143	42.0	Wempletown to Cherry Valley Blue 345 kV line 15616	160.1%	162.2%	Applicable Load Dump	2024	Byron to Cherry Valley Red 345 kV line #0622 & Byron to Cherry Valley Blue 345 kV line #0621
2q	T143	16.1	Dixon to McGirr Road 138 kV line 10714	162.3%	167.4%	Applicable Load Dump	316	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2r	T143	32.6	Zion to Pleasant Prairie Red 345 kV line 2221	144.6%	146.9%	Applicable Load Dump	1449	Cherry Valley to Silver Lake 345 kV line #15616 & Cherry Valley – W DeKalb – Glidden 138 kV line #15627
2s	T143	40.4	Silver Lake to Libertyville Red 345 kV line #13821	143.4%	145.4%	Applicable Load Dump	2024	Wempletown to T92T93 Blue 345 kV line #17101 & Wempletown to T92T93 Red 345 kV line #17102
2t	T143	30.7	Waterman to Sandwich 138 kV line #11301	140.3%	145.8%	Applicable Load Dump	558	Electric Junction - N Aurora - Sugar Grove - Waterman - Glidden 138 kV line #11106 & P20 to Electric Junction 345 kV line #18402
2u	T143	53.9	Silver Lake to Wayne Red 345 kV line #14401	132.8%	136.1%	Applicable Load Dump	1632	Silver Lake to Libertyville Red 345 kV line #13821 & Silver Lake to Tollway Blue 345 kV line #18502
2v	T143	6.7	P39 Option 2 to Edwards 138 kV line 7423	142.9%	147.0%	Applicable Load Dump	164	Kewanee to T143 138 kV line 6101 & Crescent Ridge to T143 138 kV line 7713
2w	T143	30.7	Sandwich to Plano 138 kV line #14302	132.8%	138.6%	Applicable Load Dump	537	Electric Junction - N Aurora - Sugar Grove - Waterman - Glidden 138 kV line #11106 & P20 to Electric Junction 345 kV line #18402

Steady-State Voltage Requirements

(Summary of the VAR requirements based upon the results of the steady-state voltage studies)

To be determined in the System Impact Study.

Stability and Reactive Power Requirements for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined in the System Impact Study.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

Previous projects in the PJM Queue have established the need for 345 kV reinforcements in the Byron-Nelson-Cherry Valley areas to support that generation. (See details in the Contribution to Previously Indentified System Reinforcements below). These 345 kV additions also address the overloads listed in the Generator Deliverability and Multiple Facility Contingency sections of this report.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

Byron/Nelson Area

Previous projects in the PJM Queue have established the need for two 345 kV lines from Byron to Wayne and a second Byron to Nelson 345 kV line to satisfy ComEd's transient stability criteria.

- ***Summary of Required Upgrades to Satisfy Stability Criteria***

    1. First 345kV transmission line between Byron and Wayne (56 miles). This line is required to mitigate transient stability criteria violations initially caused by the R16 project. The cost estimate for this upgrade is $**250,000,000**. (PJM Network Upgrade# N**1606**). The T143 project may have a cost allocation to this upgrade.

    2. Second 345kV transmission line between Byron and Wayne (56 miles). This line is required to mitigate transient stability criteria violations initially caused by the R33 project. The cost estimate for this upgrade is $**50,000,000** (PJM Network Upgrade# N**1638**). The T143 project may have a cost allocation to this upgrade.

    3. A new 345kV transmission line between Byron and Nelson (33 miles). This line is required to mitigate transient stability criteria violations initially caused by the R33 project. The cost estimate for this upgrade is $**125,000,000** (PJM Network Upgrade# N**1639**). The T143 project may have a cost allocation to this upgrade.

- ***Summary of Required Upgrades to Satisfy Thermal Criteria***

    1. A new 31-mile 345 kV Cherry Valley to Pleasant Valley line is proposed. One 345kV breaker at Cherry Valley substation and a three-breaker 345kV ring bus at Pleasant Valley will be required to terminate the proposed line. This line will provide a second 345 kV path between Cherry Valley and Silver Lake. The estimated costs for these facilities are $**97,000,000**. The T143 project may have a cost allocation to this upgrade.

The cost of all of the upgrades mentioned above can be in the range of hundreds of millions of dollars.

Potential Issues

TSS 184 Walton Road substation has not been built yet. If P20 withdraws, this project may be ultimately responsible for building this substation.

Other projects in the T-Queue prior to T143 demonstrate the need for long-lead time facilities including a 765 kV "backbone" transmission system tying the Byron area to the transmission

system east of ComEd. While project T143 may have some contributions to the need for this 765 kV "backbone", it may be possible to place T143 in service prior to construction of the 765kV "backbone". Including the 765 kV "backbone", the cost of all of the upgrades mentioned above can be in the range of **billions of dollars**. The allocation to project T143 for the upgrades will be determined in the System Impact Study.

Additional studies will be performed during the System Impact and Facilities Studies to determine the ability to add project T143 prior to the installation of the 765 kV "backbone". These studies will also develop the optimum plan to address these issues. If the 765kV reinforcement upgrades are built, additional studies will also be performed regarding cost allocation among these various projects.

The impacts on the AEP system due to the expansion of the 765kV system in ComEd and the new 765kV tie lines to AEP have not been studied. Additional system reinforcements may be required due to Project T143 and these line additions.

Impacts on the MISO member transmission systems are not included in this analysis, but they will be included in the Impact Study, which may reveal upgrades needed in the MISO system not identified in this Feasibility Study.

Delivery of Energy Portion of Interconnection Request

There are several wind generation plants proposed in the general area of the T143 project, each with only 20% of their peak output level considered as a Capacity Resource, and the remaining 80% as an energy only resource. If all of the wind generation plants are at their maximum output level simultaneously, a significant number of the transmission facilities, and many underlying system facilities are likely to be overloaded, restricting operation to a lower output level.

PJM and the Transmission owner studied the delivery of the energy portion of this interconnection request. The following analysis has been performed to inform the Interconnection Customer of potential congestion issues (operational restrictions) that may occur and affect the T143 project's ability to operate at full output for certain system conditions. The overloads listed below are not required reliability upgrades for the Queue T143 interconnection. Please note that the upgrades for the facilities identified below may be quite extensive with a number of these facilities possibly requiring reconductoring/rebuilding of transmission lines. Some of the reconductoring/rebuilding projects can be done in a short time frame while others are quite extensive and will require a long time to complete. In general, the time necessary to design and rebuild an extensive facility upgrade will take approximately 2-3 years to complete. If the T143 Interconnection Customer wants to pursue construction of any of these upgrades, a separate Transmission Interconnection request must be submitted and the upgrades must be performed as merchant transmission projects.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, the following overloads were determined:

Table 3 - Delivery of Energy Portion of Interconnection Request								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
3a	T143	33.0	Waterman 138 kV bus tie 2-3	413.2%	428.6%	Emergency	215	Walton Rd. (P20) to Electric Junction 345 kV line #18402
3b	T143	27.6	W DeKalb tap to Glidden portion of Cherry Valley – W DeKalb – Glidden 138 kV line #15627	299.7%	312.0%	Emergency	225	Walton Rd. (P20) to Electric Junction 345 kV line #18402
3c	T143	31.8	T92T93 to Paddock Red 345 kV line #17102	243.1%	245.5%	Emergency	1341	T92T93 to Rockdale Blue 345 kV line #17101
3d	T143	5.1	Hennepin to Oglesby Tap portion of T143 – Oglesby Tap – Mazon 138 kV line #7713	241.3%	245.8%	Emergency	110	T143 to Hennepin Station 138 kV line (Formerly line #6101)
3e	T143	27.3	T92T93 to Rockdale Blue 345 kV line #17101	229.6%	231.9%	Emergency	1214	T92T93 to Paddock Red 345 kV line #17102
3f	T143	15.3	Rock Falls to Nelson Red 138 kV line #15509	169.7%	180.7%	Normal	140	No Contingency
3g	T143	11.5	Glidden to Sugar Grove portion of Electric Junction - N Aurora - Sugar Grove - Waterman - Glidden 138 kV line #11106	175.0%	179.5%	Emergency	261	Waterman to Sandwich 138 kV line #11301
3h	T143	13.4	O29 (Schauff Rd) to Normandy portion of O09-Normandy-Kewaunee 138 kV line 7411	167.6%	177.1%	Normal	140	No Contingency
3i	T143	12.2	H71 tap to Garden Plain portion of the Nelson-Rock Falls-H71-Graden Plain 138 kV line 15518	168.8%	175.5%	Emergency	182	Quad Cities to Sub 91 345 kV line 0401 & Quad Cities to Rock Creek 345 kV line 0405 SPS
3j	T143	13.4	Kewanee to Normandy Red portion of the Kewanee - Normandy - Schauff Rd 138 kV line #7411	160.8%	168.7%	Normal	171	No Contingency
3k	T143	30.8	Nelson to Nelson Tap portion of the Nelson-Dixon-Schauff Rd 138 kV line #15508	131.0%	142.0%	Emergency	280	Nelson to Rock Falls 138 kV line #15509
3l	T143	15.8	Lancaster to Baileyville Wind Farm 138 kV line 11902	124.9%	131.7%	Emergency	232	Byron to Lee County Energy Center Blue 345 kV line #0627
3m	T143	12.2	Rock Falls to Nelson Red 138 kV line #15509	112.8%	117.4%	Emergency	270	Quad Cities to Sub 91 345 kV line 0401 & Quad Cities to Rock Creek 345 kV line 0405 SPS
3n	T143	18.8	Dixon to R65/O68 138 kV line 10721	102.2%	112.6%	Emergency	182	Byron to Lee County Energy Center Blue 345 kV line #0627

Table 3 - Delivery of Energy Portion of Interconnection Request (Continued)								
Item	Project	Contribution MW	Overloaded Element	Overload %		Rating		Contingency
				From	To	Type	MVA	
3o	T143	15.8	Lancaster to Baileyville Wind Farm 138 kV line 11902	99.8%	105.3%	Emergency	290	Byron to Lee County Energy Center Blue 345 kV line #0627
3p	T143	39.0	Nelson to Nelson Tap portion of Nelso-Dixon Red 138 kV line #15507	96.2%	105.0%	Emergency	445	Nelson 345/138 kV transformer #82
3q	T143	39.0	Nelson Tap to Dixon portion of Nelson-Dixon Red 138 kV line #15507	92.5%	101.3%	Emergency	445	Nelson 345/138 kV transformer #82

Note: *The analysis of the Potential Congestion Issues section was performed without any of the required upgrades mentioned earlier in this report.*